



Ecosystem services provided by ground vegetation in three years old willow SRC

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Introduction

- Willow SRC plantations are widely used for biomass production over the world, but their effect on local biodiversity has not been fully elucidated.
- SRC contains high richness of plant species which is important for honey bees and other pollinators, as well, legumes are important for soil quality improvement as N fixing plant, seeds or plants is food for birds.
- Although the plant composition depends largely on the previous crop, land use and management practices. Weed species have been found to affect the development of plantation crops by competing for moisture, nutrients and light.

Objective

- To evaluate the influence of previous crop, light availability, plantation age, and soil properties on ground vegetation species composition in three years old short rotation willow coppice.

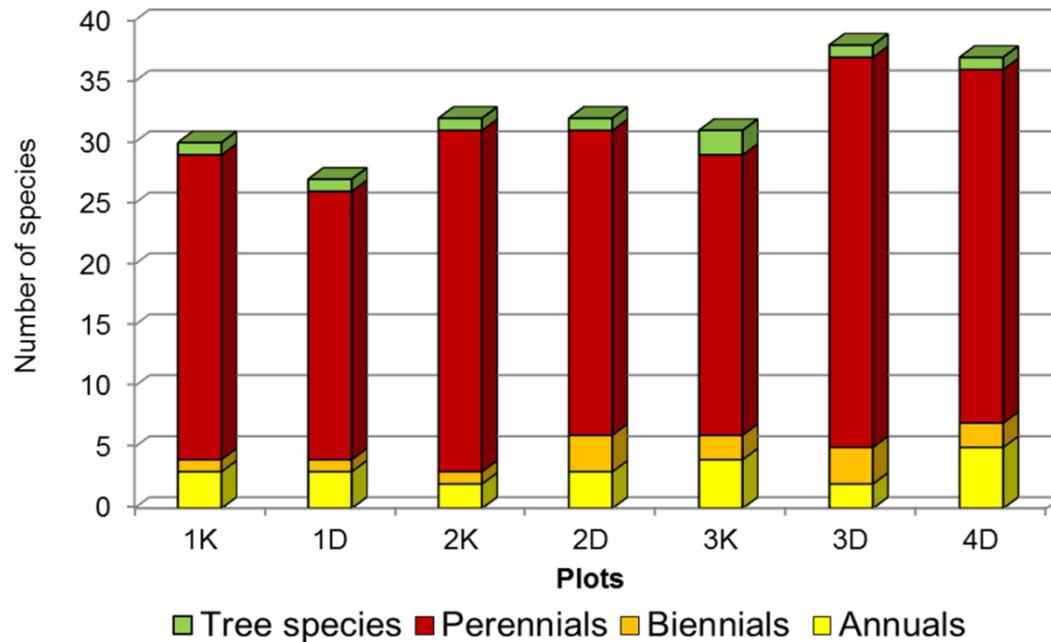
Investigation of ground vegetation and soil analyse were conducted for mix-stand of commercial willow SRC clones in Central Latvia, Skrīveri municipality.

		1 - "block"			2 - "block"			3 - "block"			4 - "block"					
2,20 m between double rows of each clone	Control - K	ash	sludge	Control - D	Control - K	sludge	Control - D	ash	Control - K	Control - D	ash	Sludge	Control - K	Control - D	sludge	ash
	Sv	Sv	Sv	Sv	Sv	Sv	Sv	Sv	Sv	Sv	Sv	Sv		Sv	Sv	Sv
	K	K	K	K	K	K	K	K	K	K	K	K		K	K	K
	I	I	I	I	I	I	I	I	I	I	I	I		I	I	I
	G	G	G	G	G	G	G	G	G	G	G	G		G	G	G
	L	L	L	L	L	L	L	L	L	L	L	L	Different species and trees from our road sides	L	L	L
	T	T	T	T	T	T	T	T	T	T	T	T		T	T	T
	St	St	St	St	St	St	St	St	St	St	St	St		St	St	St
	Bi	Bi	Bi	Bi	Bi	Bi	Bi	Bi	Bi	Bi	Bi	Bi		Bi	Bi	Bi
	Sw	Sw	Sw	Sw	Sw	Sw	Sw	Sw	Sw	Sw	Sw	Sw		Sw	Sw	Sw
	B	B	B	B	B	B	B	B	B	B	B	B		B	B	B
P	P	P	P	P	P	P	P	P	P	P	P	P		To	To	To
20 m	20 m	20 m	20 m	20 m	20 m	20 m	20 m	20 m	20 m	20 m	20 m	20 m		20 m	20 m	20 m
Fore-crops	Rape 2007 Timothy 2008-2010 (104 m)			Perennial rye grass 2007-2010 (56 m)			Meadow fescue 2007-2010 (56 m)			Red clover 2007-2009 Common barley 2010 (48 m)		Red clover 2007-2008. Fallow land 2009. Buckwheat 2010. (42 m)		Timothy 2007-2008 Fallow land 2009 Italian rye-grass 2010 (52 m)		

Sv–Sven, K– Klara, I–Inger, G–Gudrun, L–Lisa, T–Tora, St–Stina, Bi–Bimimalis, Sw–Swerini, B–Burjatica, P–Purpurea, To– Tordis

- Ground-level vegetation share in each sample plot were visually assessed using values 1, 2, 3 and 4 (later adapted to %, respectively 0-10%, 11-20%, 20- 40% and above 60%).
- Soil samples were collected at different depths of 0–20, 20–40, 40–60, 60–80 cm, prepared for analyses according to LVS ISO 11464 standard, soil pH was measured following LVS ISO 10390 standard, total nitrogen ($N_{\text{tot.}}$) according to LVS ISO 11261 (Modified Kjeldahl method).
- The qualitative and quantitative proportion of species, including species percentage cover and the mean Ellenberg indicator values of nitrogen (N), soil reaction (R), moisture (F), light (L), continentality (C) and temperature (T) of all plots were calculated.

- In total, **64 vascular plant** species and **two tree** species (*Betula pendula* Roth and *Populus* sp.) were found during the analysis of vegetation.



- Perennials are particularly dominant in ground flora level (81.3% proportion), annuals – seven species (10.9%), biennials – five species (7.8%).
- Total species number per plot varied from 27 to 41.

The most frequent species (found on all plots with highest average cover):



Agrostis gigantea (black bent)



Cirsium arvense (creeping thistle)



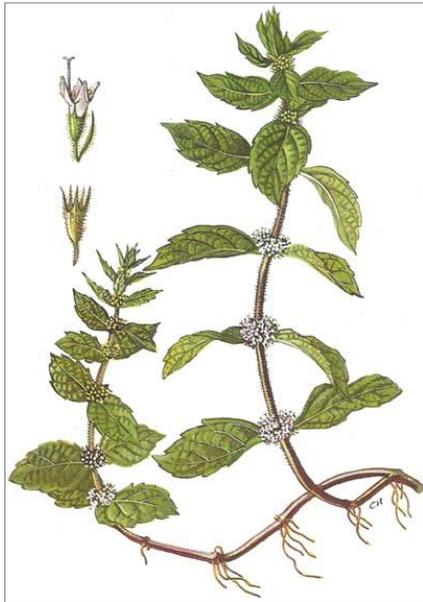
Artemisia vulgaris L. (mugwort)



Vicia cracca (tufted vetch)

Other species also found in all sites: *Hypericum perforatum* (perforate St John's-wort), *Matricaria perforata* (scentless mayweed), *Epilobium montanum* (broad-leaved willowherb), *Mentha arvensis* (corn mint), *Betula pendula* (silver birch).

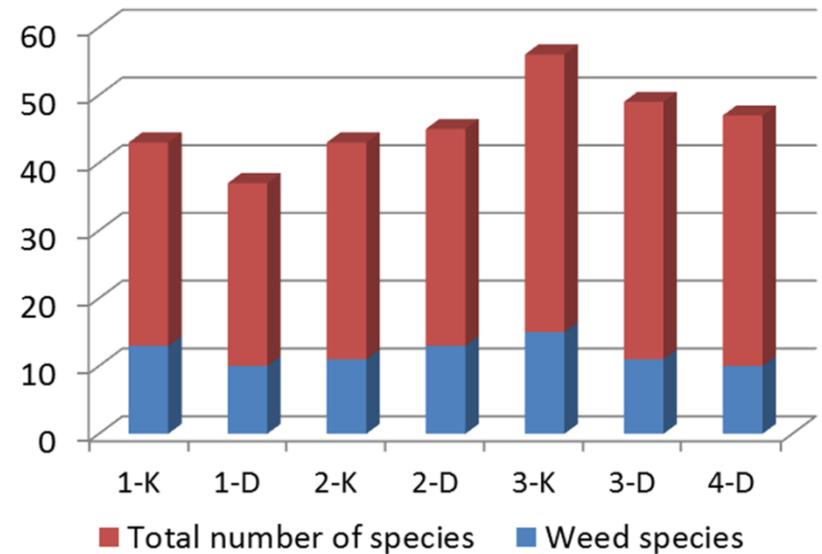
Several **weed species** typical Latvia were found. Weed species found in all plots: *Artemisia vulgaris*, *Cirsium arvense*, *Matricaria perforata*, *Mentha arvensis* and *Vicia cracca*.



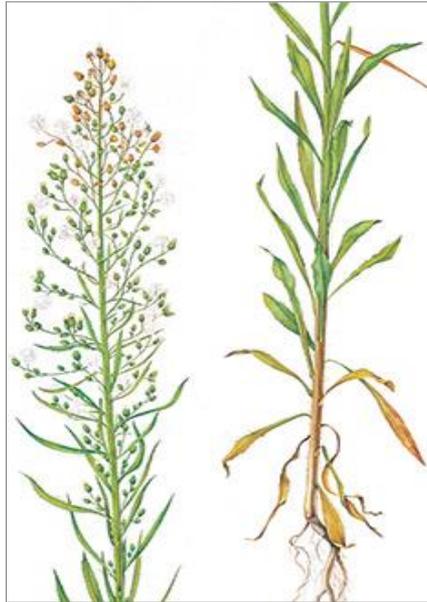
Mentha arvensis
(corn mint)



Matricaria perforata
(scentless mayweed)



According to list of **invasive species** in Latvia, two potentially invasive (*Conyza canadensis*, *Myosotis sylvatica*) and two invasive species (*Rumex confertus* and *Solidago canadensis*) were found.



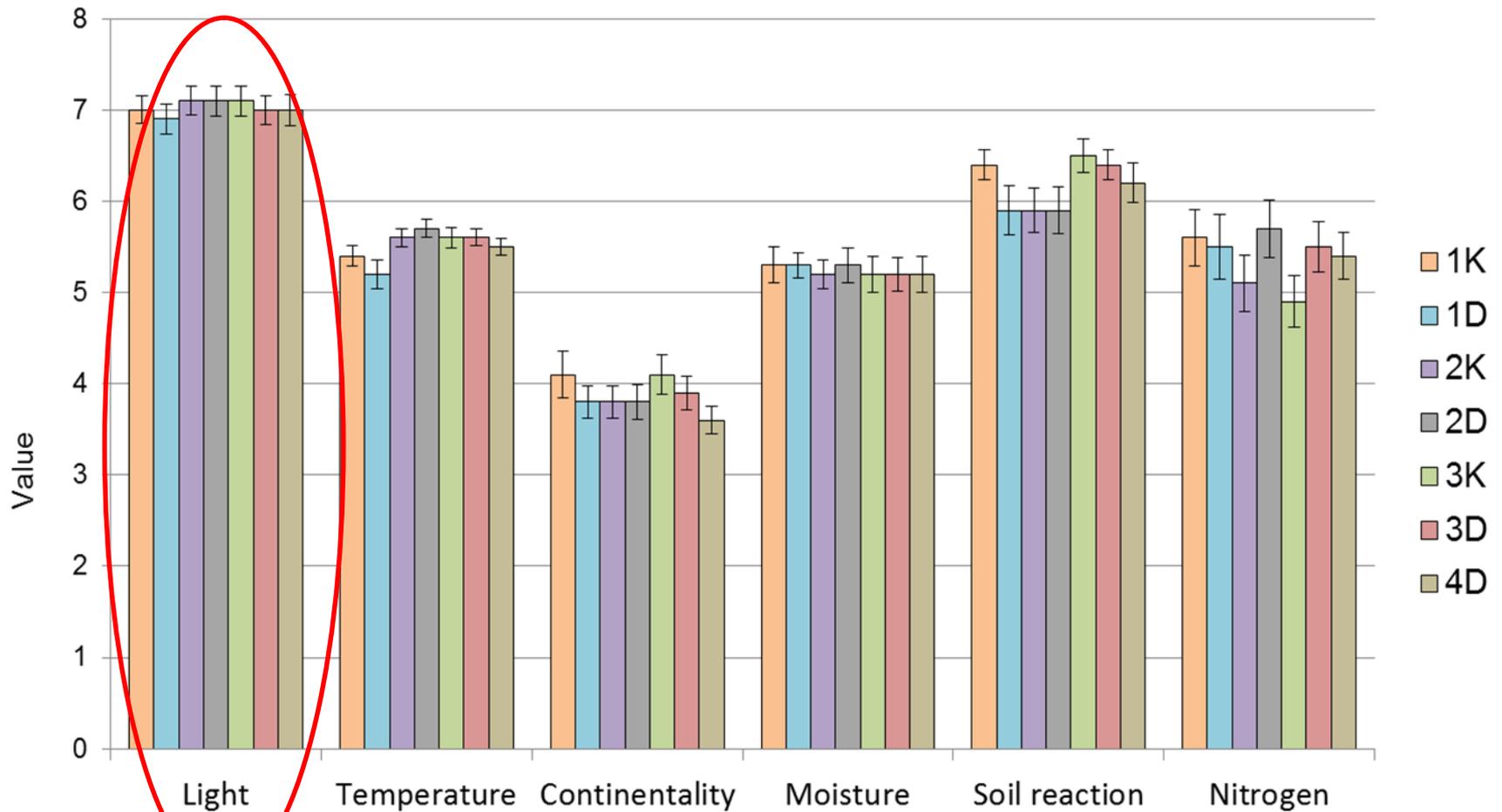
Conyza canadensis
(Canadian Fleabane)



Solidago canadensis
(Canadian Goldenrod)

S. canadensis - has spread widely in recent years in Latvia. Seeds are essential for long-distance dispersal and infestation of large territories. *S. canadensis* also is well adapted to a wide range of habitats

Mean **Ellenberg indicator values** represents that all species found in seven sample plots have high requirements to **light**. Average value of all plots 7.1 - typical for species which are more appropriate to grow in full or half- light conditions.



The **soil parameters** of analyzed sample plots in willow SRC (2011)

	Sample plot						
	1K	1D	2K	2D	3K	3D	4K
pH (CaCl ₂)	5,9	7,0	6,5	4,5	4,6	5,6	5,1
mg N _{total} * kg	0,8	1,5	3,2	0,6	0,4	0,7	0,3
mg P _{total} *kg	124,6	97,1	88,8	53,8	82,0	59,3	53,1

- The most suitable soils for willows are soils with pH 5.5–7.5 and will provide satisfactory coppice growth.
- Short rotation plants have ability to use nutrients from deeper soil layers . Obtained results show that the content of N_{total} decreases towards the deeper soil layers.

Conclusions (1)

- Flora assessment should be done for several years (during the first four years since installation) in these plantations. This would allow predicting species, which will spread more intensive and also assess their effects on planted willow clones, as similar studies of other scientists demonstrate.
- It is considering that plantations of willows on agricultural land can provide higher biodiversity compared with fields of cereals or monoculture plantings, however additional studies of vegetation also should be carried out in cereals other agricultural fields.

Conclusions (2)

- Perennial plants dominate in plantations, and some species were detected in all plots. This may indicate that, distribution of certain plants develop and stabilize over time and adapt to the specific growing conditions.
- Ellenberg values shows, that light and temperature loving plants are dominating in the plantation at the moment of research. However, these parameters likely will change, with increase in plantation age and willow size and may increase the number of shade tolerant plants until current cutting.

Thanks for your attention!